Responses to queries raised by the community in their meeting with Mr. Carlos Plazola and NIH/NCRR staff on Wednesday, July 14, 1999.

1. *Question: How will LBNL further validate the CAP88 model? The community representatives want to be reassured that the tritium exposures estimated are not orders of magnitude larger than reported because of errors in the model's parameters.*

   Response: The CAP88-PC model calculations are currently validated using ambient air measurements. This means that Berkeley Lab measures tritium in the air and compares it to what CAP88-PC predicts will be there. This program of air monitoring will continue, as a means of validating the CAP88-PC model, or any other model used to predict how tritium is dispersed. We intend to maintain this program as long as the NTLF operates. For example, ambient air measurements at the Lawrence Hall of Science for 1998 were less than half the value predicted by CAP88-PC. This shows that the model agrees fairly well with the measurements, in spite of the complex terrain, and actually provides an estimate for the potential dose which is above that determined from sampling. For an extra margin of safety and in keeping with regulatory requirements, Berkeley Lab chooses the higher CAP88-PC modeled level when calculating the potential dose to the public. A lower dose would be calculated if Berkeley Lab used actual ambient air measurements. Monitoring of tritium in the urine of people working near the NTLF and at the LHS also confirm that exposures are conservatively estimated with the modeling data and measured releases.

2. *Question: Why does the LBNL use the CAP88 model?*

   Response: The U. S. Environmental Protection Agency (US EPA) requires the use of CAP88 in their regulation: 40 CFR Part 61, Subpart H (National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities) to demonstrate compliance. We believe they do so to standardize reporting of exposures related to releases, making everyone adhere to the same assumptions. There are few computer programs available to calculate the dispersion of tritium and the resulting dose. We will work with other laboratories to adapt programs to do modeling, and to modify them as needed for our situation, in order to provide dose estimates to augment those from CAP88. Regardless of model it remains most important to have real measurements of tritium levels to verify the real exposures.

3. Question: *Is the way the CAP88 model used by LBNL to estimate exposures valid for the Lawrence Hall of Science because of the geographic relationship of the NTLF and the LHS? The LHS appears to be at the same level as the top of the stack because of*

this relationship -- does that invalidate use of the CAP88 model? Does the stack need to be extended by several meters?

Response: Berkeley Lab's experience with CAP88-PC and validation with direct monitoring results give us confidence that CAP88-PC does a good job at conservatively estimating risk from tritium with the stack in its present form. CAP88-PC is in fact a model that is designed for flat terrain. We should also acknowledge that models have difficulty mathematically reproducing sampling results within the area immediately surrounding the release point. However, in the case of the NTLF, this limitation affects only a small area within the Laboratory boundaries, and should not affect modeling even at the LHS. Despite the limitations, CAP88-PC is the only model accepted by US EPA for compliance modeling.

While not perfectly suited for the complex terrain of Berkeley Lab, CAP88-PC's results compare favorably with the Laboratory's ambient air monitoring results—not just at the Lawrence Hall of Science site, but also at other sites within the monitoring network. As noted above it also provides an upper estimate for doses when compared with direct urine monitoring. The ambient air samplers operate continuously, with samples changed monthly for analysis by an independent, certified analytical laboratory.

4. *Question: How does the LBNL determine wind speed and direction to enter into the CAP88 model?*

   Response: Berkeley Lab maintains a meteorological monitoring tower on the Laboratory property which collects weather data including wind speed, direction and stability. The tower is located less than 200 meters southwest of the NTLF stack and the sensors are mounted at a height of 20 meters. Twice a year, these sensors are checked by an independent, qualified auditor. Each year, Berkeley Lab prepares a computer file containing the collected wind data. The file is formatted so that the data can be loaded into the CAP88-PC model, which then calculates how tritium released from the stack is dispersed.

5. *Question: Why hasn't the LBNL placed an instrument between the NTLF and the LHS to measure wind speed and direction?*

   Response: Berkeley Lab will install such an instrument. When it installed the current monitoring tower, Berkeley Lab followed the guidance documents from the US EPA, the Bay Area Air Quality Management District, and the Department of Energy for selecting a meteorological monitoring site. These guidelines are intended to assure a representative sampling of the overall weather patterns in the area. A height of 20 meters is appropriate to characterize wind flow patterns for the nearby area, including the NTLF stack. For Lab-wide regulatory modeling, a meteorological tower between

the NTLF and the LHS would not be suitable since the data would likely be modified by local effects. The agreement of the modeling results for LHS with the air sampling data give us confidence that the wind data from the nearby tower are representative of the overall behavior in the vicinity of the stack. To confirm this, however, the lab will do specific monitoring in the area of the stack.

6. *Question: The community is concerned that an individual can walk out the back of the LHS to an area at the level of the perimeter fence of the NTLF and be inadvertently exposed to higher tritium concentrations. What can be done about this apparent increased risk?*

   Response: Based on extensive air modeling and monitoring in the vicinity of the NTLF, Berkeley Lab does not expect that persons in the described scenario would experience any significant increase in risk from tritium emissions from the NTLF. However, Berkeley Lab will install an ambient air and meteorological monitoring station in the eucalyptus grove at the perimeter fence. This way, the predicted air concentration can be checked against an actual measured value the same way it is at the LHS.

7. *Question: Does LBNL use the CAP88 model to estimate inadvertent, acute releases of tritium?*

   Response: No, Berkeley Lab uses another model called Hotspots, which is designed for acute releases, to estimate exposures and hence risks in such cases. Hotspots uses release information, taken directly from measurements, and determines worst-case impacts by modeling the release, independent of actual meteorological conditions (tritium is assumed to move in a direction to give maximum exposure rather than the real direction of wind). Berkeley Lab has on occasion used CAP88-PC as well on these acute releases to factor in local meteorological conditions for comparison with Hotspots modeling results.

8. *Question: Why is there such a marked delay--several days up to more than a week--in notifying the community about the accidental releases of tritium? Why do the levels of tritium reported released by the LBNL vary sometimes?*

   Response: The accidental releases which have occurred from the NTLF are relatively small in size, a small fraction of the annual release, and below regulatory reporting levels. Accordingly, the additional risk from the accidental releases must be also be small. The community would be notified immediately in the event of an accidental release that significantly increased exposure and risk.

   Although real-time monitoring indicates when any release occurs, as well as its approximate size, it is not possible to immediately determine the precise amount of

the release from such data. The quantitative data come from continuous samplers, from which the collectors must be removed and analyzed, a process that takes time. This time accounts for the delays in reporting releases. In one recent case the estimate of a release was made after the initial analysis was completed. Subsequently we realized there was possibly an error in that measurement, and the correct value was established, which lead to the revision of the initially reported value.

9. *Question: Does the silica gel sampling provide an accurate estimate of the tritium released up the stack? How is this validated?*

   Response: Yes, silica gel is recommend for monitoring tritiated water in air by the US EPA NESHAP regulations (40 CFR 61). Berkeley Lab performs stack sampling using silica gel at the National Tritium Labeling Facility in accordance with NESHAP regulations. Such procedures are selected by the regulatory agencies only after testing with known, calibrated conditions to see that they do in fact correctly reflect the levels which they are designed to monitor.

   Berkeley Lab carefully designed their air sampling systems, taking into account the water holding capacities of the silica gel, air sampling flow rates, sampling time period, and ambient humidity levels in Berkeley. In addition, Berkeley Lab uses silica gel that contains an indicator dye which changes color as it adsorbs water. By using indicator silica gel, Berkeley Lab is able to verify that the water holding capacity of silica gel samples are not exceeded during sampling. A recent paper from Los Alamos National Laboratory (Eberhart, 1999) reinforces the importance of correctly designing and operating a silica gel system for the environment that is monitored.

10. *Question: In the event of a serious fire or earthquake, what will happen to the stored tritium and what will be the risk to people in the area of the release and miles away? What effect would an inversion, commonly present in this geographic area, have on dispersion of tritium and the level of exposure?*

    Response: An analysis of the exposures which could arise from a major event (such as earthquake or fire) has been reported in the Laboratory Safety Analysis Document. Because of the way the tritium is stored, heat is required to release it from the storage bed. As a result, the only release which could occur during an earthquake would be that tritium which was in actual use at the time the earthquake occurred—a small fraction of the total inventory.

    The only type of event which could release the full inventory of tritium is a “fully involved” fire (such as the Oakland firestorm). Such a fire could convert the tritium to tritiated water at the same time that it is released from the bed, a process that would occur only after the building was engulfed in flames. All dispersion models used for determining impacts from an incident such as a firestorm consider atmospheric

stability as a variable. An inversion is generally associated with the most stable atmospheric conditions. Accordingly, an inversion would indeed reduce upward dispersion and result in higher ground level concentrations when compared with non-inversion conditions. However, a major fire (of the type which could release the tritium inventory) would create its own tremendous updrafts, mixing the tritated water with large volumes of air even if an inversion were present. Accordingly, even in an accident scenario such as this, the exposures to people in the area remain low. This is another area in which further modeling will improve our quantitative understanding of dispersion and doses.

11. *Question: What is the risk of acute tritium release with the "waste treatment" procedure that LBNL staff have recently developed? Why isn't this procedure carried out in an already established hazardous waste facility?*

    Response: There is little likelihood of any future significant releases of tritium from the "treatability study" Berkeley Lab is conducting at the NTLF. In 1998, 35 curies of tritium were released to the environment, however the step that lead to the release has been eliminated. The remaining steps are conducted in a closed system (made of stainless steel), located within a enclosing box that would capture an accidental release of tritium.

    A "treatability study" is not standard waste treatment, but rather the development of a new approach for waste treatment. In a study of this sort the amount of waste that can be treated is limited, and the progress of the study must be reported to the state. (The term “treatability study” is defined in Title 22 of the California Code of Regulations, Section 66260.10 and has specific meaning which distinguishes it from "waste treatment.") As such, it wouldn't necessarily be done in the Berkeley Lab waste handling facility where we conduct all other established, permitted mixed and radioactive waste treatments. The NTLF has the proper monitoring and analysis equipment for this study as well as staff experienced in safely handling tritiated compounds, such as the treatability study samples, making the NTLF the most appropriate site for carrying out the work.

12. *Question: Is the LBNL moving its boundary to accommodate an enlarging tritium plume?*

    Response: No, the Berkeley Lab boundary was extended in order to improve the management of wildland fire risks. For many years, Berkeley Lab has had a well-developed vegetation management program to reduce the risk of wildland fire damage in the Oakland/Berkeley hills. This program was intensified in response to the devastation of the Oakland fire of 1991.

Initial estimates of the size and position of the tritium plume were made on the basis of sampling "wells" dug in the area. The number of these wells has been increased over the past few years to provide additional information about its position. With more wells it was determined that the region containing tritium is in fact irregular in shape (and so extends into an area that had not been previously characterized). There are wells very close to those within the plume which do not show tritium, indicating a fairly sharp boundary. Monitoring over a considerable period now indicates that the "plume" is in fact not expanding significantly, which is consistent with our knowledge of the soil and ground water in the area.

13. *Question: The IEER has been contracted by the community to carry out an independent sampling of the LBNL area. The community wishes to know if the LBNL will cooperate in this effort?*

    Response: The Berkeley Lab welcomes the opportunity for an independent evaluation of the Berkeley Lab environmental monitoring program. We will work to provide the data needed to make such an evaluation meaningful.